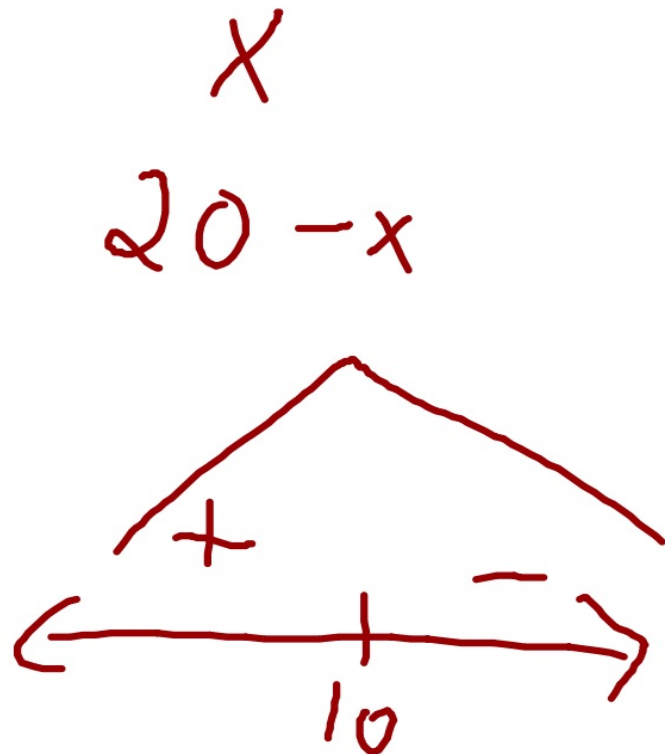


Section 4.4

Modeling and Optimization

Find two numbers whose sum is 20 and whose product is as large as possible.



$$f(x) = x(20-x)$$

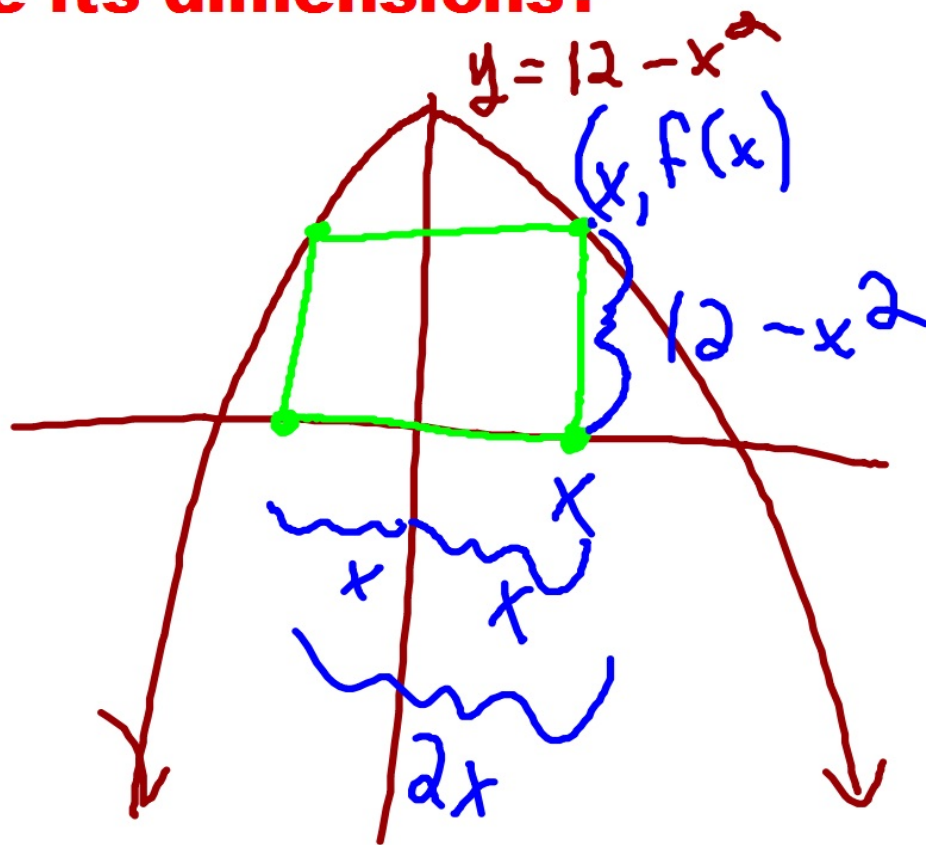
$$f(x) = 20x - x^2$$

$$f'(x) = 20 - 2x$$

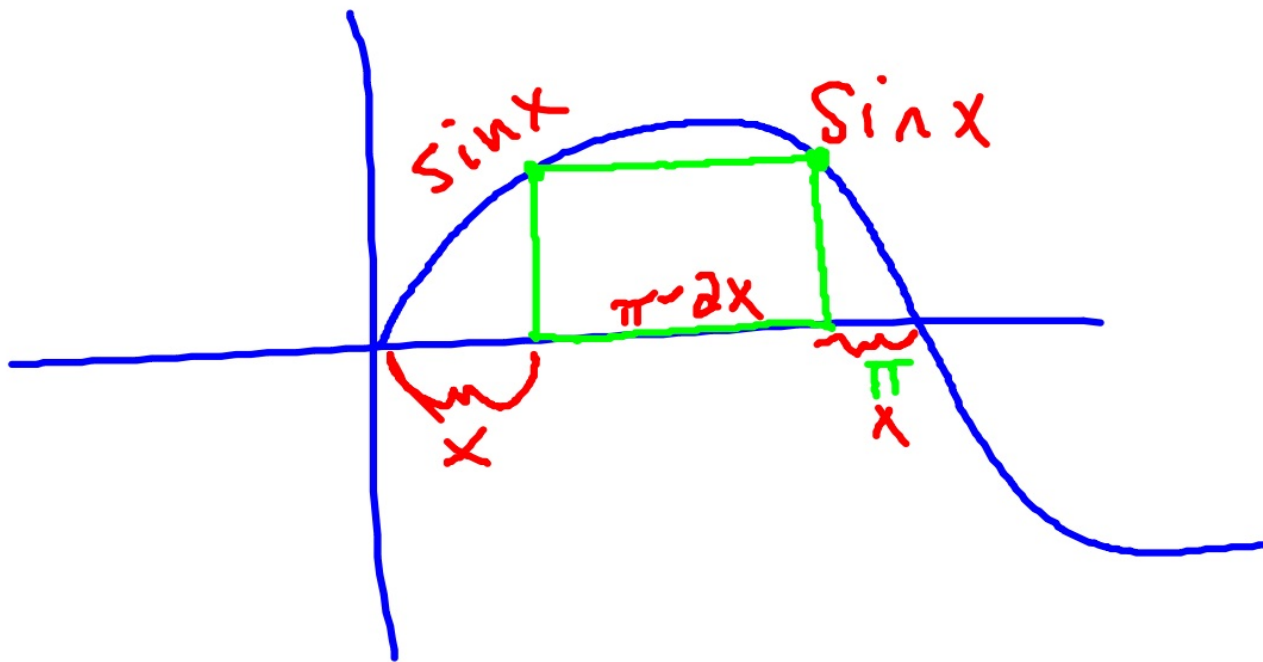
$$20 - 2x = 0$$

$$x = 10$$

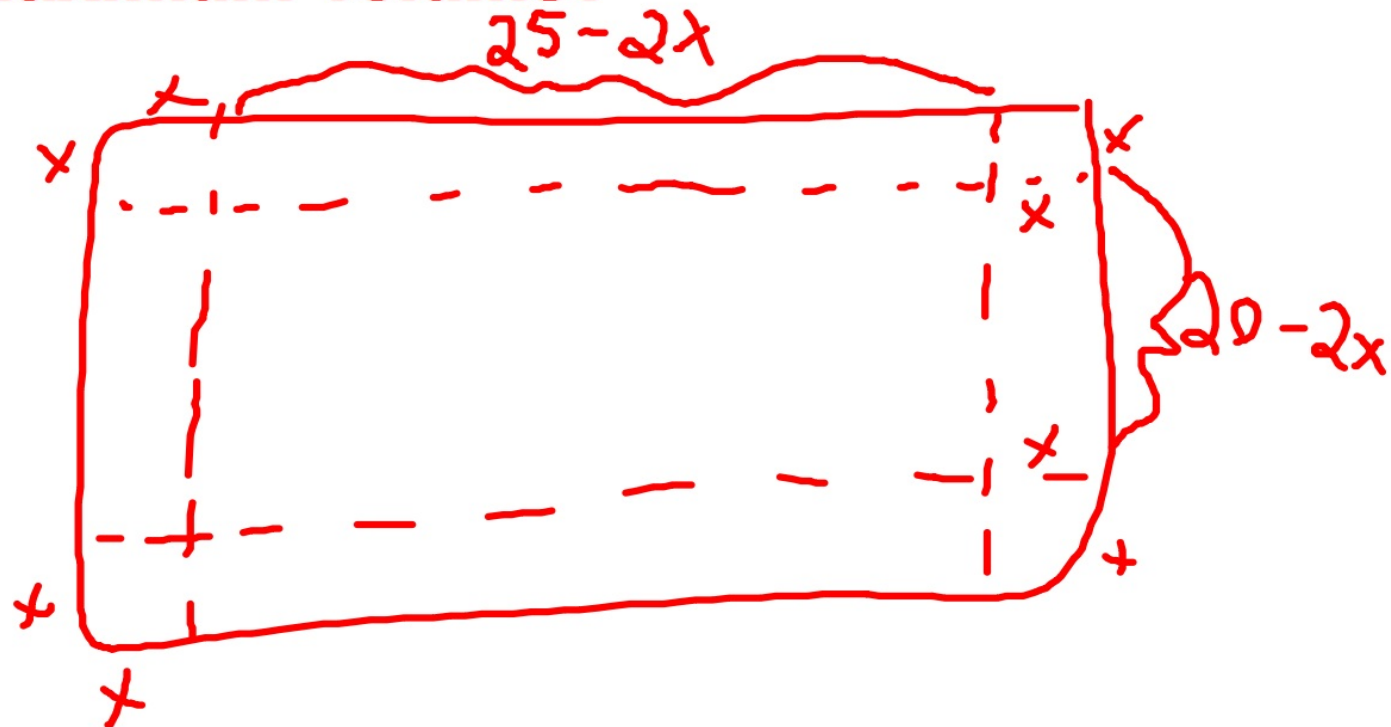
A rectangle has its base on the x-axis and its upper two vertices on the parabola $y = 12 - x^2$. What is the largest area the rectangle can have, and what are its dimensions?



A rectangle is to be inscribed under one arch of the sine curve. What is the largest area the rectangle can have, and what dimensions give that area?



An open top box is to be made by cutting congruent squares of side length x from the corners of a 20 inch by 25 inch sheet of tin and bending up the sides. How large should the squares be to make the box hold as much as possible? What is the resulting maximum volume?



You have been asked to design a one-liter oil can shaped like a right circular cylinder. What dimensions will use the least material?

$$1 \text{ liter} = 1000 \text{ cm}^3$$

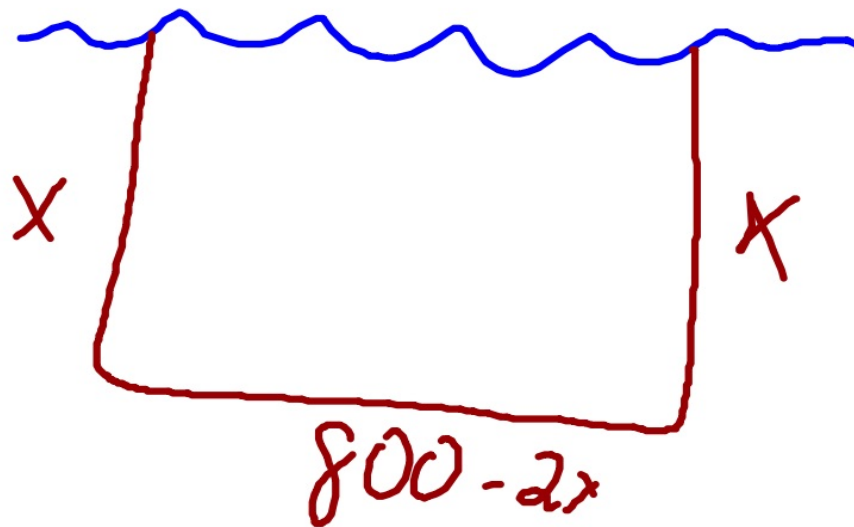
$$SA = \underbrace{\pi r^2}_{\text{Top}} + \underbrace{\pi r^2}_{\text{Bottom}} + 2\pi r h$$

$$SA = 2\pi r^2 + 2\pi r h$$

$$SA = 2\pi r^2 + 2\pi r \left(\frac{1000}{\pi r^2} \right)$$

$$SA = 2\pi r^2 + \frac{2000}{r}$$

A rectangular plot of farmland will be bounded on one side by a river and on the other three sides by a single strand of electric fence. With 800 meters of wire at your disposal, what is the largest area you can enclose, and what are its dimensions?



Page 226 - 227

Numbers 1 - 7, 9 - 11, 18, 19